

Remarks

New status of the application

All of original claims 1-20 are cancelled. New claims 21-40 are submitted for examination.

Fig. 2 is amended to harmonize the numeral references with those in the specification as amended.

The specification has been amended to address issues raised in the pending Office Action.

Summary of the amendments

An amended Figure 2 is attached to this Response. Figure 2 has been amended to eliminate the examiner's objection to the drawing. The examiner noted that there was nothing in Fig. 2 labeled 220 corresponding to the specification reference to "virtual drive segments 220" on page 7. This correction necessitated amendment to the specification to differentiate the noted reference to "virtual drive segments 220" from "virtual disk 220" appearing at page 7 line 15. The reference numeral for the "virtual drive segments" is changed to 222 while the reference to "virtual disk 220" remains unchanged. Both reference numerals now appear in the drawing correctly indicating their respective elements in the mapping table 200 illustrated in Fig. 2.

The examiner objected that the "blocking flag" is nowhere described or adequately discussed in the specification. The Applicants respectfully disagree. There is ample information about the blocking flag and its purpose in the original disclosure. Beginning on original page 12 line 12 of the specification there is a description of the exchange of command/response information between the controller and one or more mapping agents. The controller, exercising its singular control over the contents of the mapping table, may command the agent to either set information in the table. When commanding the agent to set either all of the table entries or one of the states for a table entry, the controller's command to the agent "optimally" includes a blocking flag or state.

That reference, "blocking flag or state", conveys to a person of ordinary skill in the art that the blocking flag is a logical signal. That is confirmed in the specification, which informs

that “the blocking flag may be stored with each entry in the table 200 similar to the other states described above.” Thus, the blocking flag, like the other state variables in the table (see Fig. 2), is a logical signal that is set or cleared depending on the operation that the controller and agent are performing. It may or may not be a table entry; it could simply be a signal in a message between the controller and agent.

An example of the use of the blocking flag is described in the original specification at page 15 lines 4-14. In the process of activating the Nw (no-write) state, the controller uses a set_entry_state command to communicate a change to Nw state to all of the mapping agents during a disk copy operation. The set_entry_state command signals the mapping agents to activate the blocking flag. The controller does not get signaled that an agent has activated its blocking flag until all I/O operations are complete for that agent. Only then does the controller receive a response that the Nw state is changed and the blocking flag is set. That is how the controller is informed that all in-progress I/O operations to the original disk are complete, after which the contents of the mapping table are copied to a new mapping table for the disk copy (snapshot disk). Another example of this sequence is described at page 18 lines 1-9 for the reverse-delta process.

In order to alleviate any doubt as to the purpose of the blocking flag, the specification has been amended in the paragraph beginning at page 15 line 4, consistent with the above-described specification sections, changing the first sentence reference to the blocking flag to: “...to activate the blocking flag that blocks the controller from initiating the table copy until prior I/O operations that were in progress against virtual disk segment 222 at the time of the set entry operation have completed.” With the several descriptions of the blocking flag in the specification, together with this amendment that is condensed from the existing descriptions, there should be no remaining description issue about the blocking flag. It is a simple logical signal, no more and no less. The amendment in the specification merely refers to what is already in the description and adds no new matter to the disclosure.

Claim rejections

The examiner rejected claims 9, 11 and 17-18 under 35 U.S.C. § 112 for indefiniteness. These claims have been canceled in this Amendment rendering the rejection moot.

The examiner rejected claims 1, 8, 10, 12, 14 and 16 under 35 U.S.C § 102(b) as anticipated by the Compaq Tech Note reference (the Veritas document). He further rejected claims 2-7 and 13-15 as obvious in view of the Veritas document in view of “common practices in the art” and other prior art (unspecified).

Because all of the rejected claims have been canceled, these rejections are now moot.

The newly submitted claims are directed to a distributed network storage system and method for its operation. Nothing in the examiner’s citation of prior art addresses such a system. These claims are submitted for consideration and allowance.

Request for Information

The examiner attached a Request for Information under 37 C.F.R. § 1.105. The Request was directed to the section of the disclosure at page 2 lines 7-12 in the application in which certain “known methodologies” were mentioned. The Request asked for provision of any non-patent literature, published application or patent that related to those items.

The section of the disclosure in question referred to “known methods” of disk copying that (i) did not provide fast copies, (ii) were not space efficient, and (iii) were fast and space-efficient but did not operate in a scaleable, distributed, table-driven virtual storage system. The known methods referred to were disk mirroring, disk duplexing, and disk shadowing, all known to the art.

Examples of each of these techniques are described in the several patent references enclosed with this Response. U.S. Pats. 4,862,411 and 5,210,866 are examples of fast but space inefficient copy processes, backups and disk copies. Disk-mirroring and disk shadowing are described in U.S. Pat. 5,764,903. Space efficient non-distributed copying is described in U.S. Pat. 6,665,815. Snapshot copies are described in U.S. Pat. 6,038,639. Each of these patents relates to the “known methodologies” mentioned in the specification.

An Information Disclosure Statement listing each of these references accompanies this Response. The fee under 37 C.F.R. § 1.97 has been waived in the Request for Information.

The Applicants have responded completely to the Office Action mailed 2/24/04, including the Request for Information that accompanied the Action. New claims 21-40 are submitted for examination and allowance.

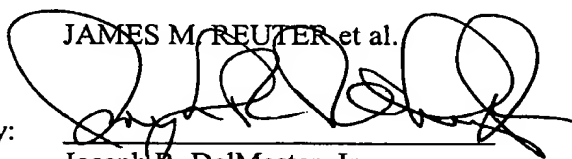
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ATTACHMENT

New Figure 2



200

220

Virtual storage	Actual location		Invalid	Nw	Zero	Error
	LUN	Block(s)				
1	1	1	No	No	No	No
2 - 11	2	1 - 10	No	No	No	No

233 235 240 250 260 270

210 222 230

Fig. 2